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ABSTRACT

The course covers the standards used in the electronic field, electrical drawings, electronic drafting, and parts of functional drafting. The student will become familiar with symbols used in these fields and become proficient with tools and reference material used in drawing schematics and mechanical details and in electrical and electronic fabrication problems. Mastery of skills indicated in Working, Welding and Structural Drafting--9255.03 are prerequisites to the course. Totaling 135 clock hours, the course consists of seven instructional blocks: (1) introduction to electronic drafting, (2) introduction to electrical drafting, (3) functional drafting, (4) threads and fasteners, (5) pictorial drawings, (6) piping drafting, and (7) Quinmester posttest. The bibliography lists basic references, workbooks, and supplementary reference works, and a sample posttest concludes the document. (Author/MW)

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# AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

DADE COUNTY PUBLIC SCHOOLS

Course Outline
DRAFTING 3 - 9257
(Electrical and Electronic Drafting)
Department 45, 48 - Quin 9257.01

CE001 993

DIVISION OF INSTRUCTION • 1973

ED 095424

D A D E  C O U N T Y  P U B L I C  S C H O O L S

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M I A M I,  F L O R I D A  33132

Course Outline

# DRAFTING 3 - 9257
(Electrical and Electronic Drafting)

Department 45, 48 - Quin 9257.01

county office of

VOCATIONAL AND ADULT EDUCATION

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Dr. E. L. Whigham, Superintendent of Schools
Dade County Public Schools
Miami, Florida 33132

April, 1973

Published by the School Board of Dade County

## Course Description

| 9257 | 45 & 48 | 9257.01 | Electrical and Electronic Drafting |
|---|---|---|---|
| State Category Number | County Dept. Number | County Course Number | Course Title |

This course covers the standards used in the electronic field. The student will become familiar with symbols used in these fields and become proficient with tools and reference material used in drawing schematics and mechanical details and in electrical and electronic fabrication problems. The student will also produce drawings using functional drafting.

Indicators of Success: Prior to entry into this course the vocational student will display mastery of the skills indicated in Working, Welding and Structural Drafting - 9255.03.

Clock Hours: 135

# PREFACE

The following quinmester course outline is presented as an introduction to electrical and electronic drafting. This course covers electrical drawings, electronic drafting and parts of functional drafting. The student is introduced to various types of tools and equipment and is provided with an opportunity for instruction and laboratory experiences.

This course is taught in a two-hour block for 90 hours or a three-hour block for 135 hours. In each instance, the course consists of seven instructional blocks, however, the three-hour session permits the learner to cover each block in more detail and also provides additional opportunity to practice and increase his or her skills. The course is concluded by a post-test.

An adjunct to the listed instructional methods is provided through the instructor's utilization of audiovisual equipment and materials.

The bibliography lists the basic reference, workbooks, and supplementary reference used by the teacher in presenting the material. These books are available to the student through the instructor.

This outline was developed through the cooperative efforts of the instructional and supervisory personnel, the Quinmester Advisory Committee and the Vocational Curriculum Materials Service, and has been approved by the Dade County Vocational Curriculum Committee.

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with Suggested Hourly Breakdown


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## GOALS

The student must be able to demonstrate:

1. The ability to develop and direct his or her activities along lines parallel to present day drafting practice.

2. Skills in the selection and handling of tools and equipment through organized practice sessions in the related field of fasteners of all types.

3. The skills needed to perform as a draftsman with assigned tasks that may require pictorial drafting. The student will become knowledgeable with drawings that require illustration in the industry.

4. The ability to advance his knowledge and skills in drafting to meet the requirements of the electrical and electronic industry.

5. The desire for advancemenet in his chosen vocation by introducing and keeping before him achievements of leading machine designers, engineers and draftsmen, especially in the piping field.

6. The use of tools and equipment to perform a task in a predetermined length of time and to the satisfaction of a drawing checker.

## SPECIFIC BLOCK OBJECTIVES

### BLOCK I - INTRODUCTION TO ELECTRONIC DRAFTING

The student must be able to:

1. Prepare various types of electronic drawings and become familiar with the trade in general.
2. Draw schematic diagrams and learn the component symbols; also become familiar with all the types of drawings used by the electronic industry.
3. Exhibit the ability to use most of the symbols that are necessary in the electronic field and to associate these symbols with the product that is being built by the shop or field.

### BLOCK II - INTRODUCTION TO ELECTRICAL DRAFTING

The student must be able to:

1. Prepare various types of electrical drawings and become familiar with the trade in general.
2. Draw schematic diagrams and learn the component symbols; also become familiar with all the types of drawings that are used by the electrical industry.
3. Exhibit the ability to use most of the symbols that are necessary in the electrical field and to associate these symbols with the product that is being built by the shop or field.

### BLOCK III - FUNCTIONAL DRAFTING

The student must be able to:

1. Discuss the "Vital Point" as related to working drawings.
2. Explain the two facts very important to functional drafting.
3. Construct all future drawings along the guide line of functional drafting.
4. List the 12 basic rules or steps that make up functional drafting.

### BLOCK IV - THREADS AND FASTENERS

The student must be able to:

1. Prepare drawings that entail the use of screw threads and know how to draw all the types that are described in the block in reference.
2. List, in the bill-of-material, necessary information that corresponds with the field of the drawing.
3. Demonstrate an understanding of all types of threaded fasteners and be able to determine the size, material, quantity and remarks in the bill-of-material.
4. Draw all types of keys and know their use and function to the operation that the student is preparing.
5. Construct drawings that call for the use of rivets of the common type and become familiar with the use of these fasteners in various fields of engineering.

BLOCK V - PICTORIAL DRAWINGS

The student must be able to:

1. Draw isometric pictures in the form of drawings and sketches for preliminary design and production use in the fields that call for this type of presentation.
2. Prepare oblique drawings and sketches that could be best presented in this manner and become familiar with the construction procedure and all the elements that go into planning oblique drawings.
3. Draw one-point perspectives and know the use of this type drawings.
4. Define the use of optic laws and the nomenclature of lines and points.
5. List the basic elements and be able to plan basic layout for one-point perspective drawings.
6. Draw two-point perspectives and know what the use of these types of drawings are.
7. Define the use of optic laws and the nomenclature of lines and points.
8. List the basic elements and be able to plan basic layout for two-point perspective drawings.

BLOCK VI - PIPING DRAFTING

The student must be able to:

1. Draw various types of piping drawings and become familiar with the trade in general.
2. Demonstrate knowledge of the various types of pipe and fittings and the standard code for pressure.
3. Diagram the standard symbols that are used in this field and know the reasons why they are used.
4. Identify the various types of pipe and fittings used in this work.
5. Draw one-line and two-line drawings which are required in the piping field.

BLOCK VII - QUINMESTER POST-TEST

The student must be able to:

1. Satisfactorily complete the quinmester post-test.

Course Outline

DRAFTING 3 - 9257
(Electrical and Electronic Drafting)

Department 45, 48 - Quin 9257.01

I. INTRODUCTION TO ELECTRONIC DRAFTING

A. Introduction
1. Types of drawings
a. Electrical
(1) Engineering sketch
(2) Block diagram
(3) Tabular
(4) Schematic
(5) Wiring diagram
(6) Printed circuit
b. Mechanical
(1) Layout
(2) Assembly
(3) Detail
(4) Installation
c. Graphic
(1) Charts
(2) Graphs
(3) Monogram
2. Tools and equipment
a. Templates
b. Tape-up

B. Symbols
1. Drawing
2. Use of
3. Component values

II. INTRODUCTION TO ELECTRICAL DRAFTING

A. Introduction
1. Types of drawings
a. Electrical
(1) Engineering sketch
(2) Circuit diagrams
(3) Wiring diagram
b. Mechanical
(1) Structural
(2) Pictorial
2. Symbols
a. Electrical
b. Electronic

B. Circuit Components
1. Operation
2. Purpose

III. FUNCTIONAL DRAFTING

A. Vital Point
   1. Definition
      a. For who
      b. For what
   2. Importance

B. Simplification
   1. Definition
   2. Types
      a. Avoid artistry
      b. Repetitive details
      c. Unnecessary details
      d. Describe in lieu of drawing
      e. Avoid excess details
      f. Assembly drawings - simple
      g. Simple parts on a list
      h. Use templates
      i. Avoid excess fabrication details
      j. Hold "material" indications to a minimum
      k. Symetry
         (1) Definition
         (2) Use of
      l. Symbols
         (1) Definition
         (2) Use of

IV. THREADS AND FASTENERS

A. Screw Threads
   1. Drawing
   2. Labeling
      a. Representation
      b. Nomenclature
   3. Types
      a. American Standard
      b. Left and right
      c. Miscellaneous
      d. Pipe

B. Threaded Fasteners
   1. Drawing
   2. Calling out
      a. Size
      b. Material
      c. Quantity
      d. Remarks
   3. Types
      a. Definitions
      b. Use of
      c. Reasons
      d. Miscellaneous

IV. THREADS AND FASTENERS (Contd.)

C. Keys
  1. Types
    a. Square
    b. Pratt & Whitney
    c. Woodruff
    d. Machine pins
  2. Use of

D. Rivets
  1. Types
    a. Button head
    b. Cone head
    c. Pan head
    d. Flat head
    e. Round head
  2. Use of
  3. Drawn

V. PICTORIAL DRAWINGS

A. Isometric
  1. Projection
    a. Definition
    b. Construction procedure
    c. Use of
      (1) Pictorial
      (2) Illustration
  2. Drawing
    a. $30^{o}$ Y-Axes method
      (1) First position
      (2) Second position
      (3) Reverse axes
    b. Elements
      (1) Lines
      (2) Planes
      (3) Diagonals
      (4) Circular
  3. Sketching
    a. Use of
      (1) Preliminary design
      (2) Inventing
    b. Field use

B. Oblique
  1. Projections
    a. Definition
    b. Construction procedure
    c. Use of
      (1) Pictorial
      (2) Illustration
      (3) Conditions

2. Drawings
   a. Planning diagonal construction
   b. Elements
      (1) Lines
      (2) Planes
      (3) Diagonals
      (4) Circular
   c. Planning curvilinear
3. Sketching
   a. Use of
      (1) Preliminary design
      (2) Inventing
   b. Field use

C. One-Point Perspective
1. Projection
   a. Using fundamental optic laws
   b. Nomenclature of lines and points
      (1) Horizon
      (2) Ground line
      (3) Station point
      (4) Picture plane
      (5) Center vision point
   c. Resolving views
   d. Procedure of construction
   e. Projection procedure
   f. One-point limits
      (1) Not pleasing
      (2) Interior illustration
2. Drawing
   a. Selecting station
   b. Planning basic layout
   c. Elements
      (1) Lines
      (2) Planes
      (3) Diagonals
      (4) Circular

D. Two-Point Perspective
1. Projection
   a. Planning location of two-points
   b. Executing two-point developments
   c. Nomenclature of lines and points
      (1) Ground line
      (2) Station point
      (3) Horizon
      (4) Right and left vanishing points
      (5) Picture plane
   d. Projection procedure
   e. Procedure of development
   f. Two-point limits
2. Drawing
   a. Planning basic layout
   b. Executing basic layout

V. PICTORIAL DRAWINGS (Contd.)

c. Elements
(1) Lines
(2) Planes
(3) Diagonal
(4) Circular

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VI. PIPING DRAFTING

A. Types
1. Schematics
2. Isometric
3. Oblique
4. Detail
5. Installation

B. Identify
1. Types of pipe
2. Fittings
3. American Standard code for pressure

C. Symbols
1. One-line
2. Two-line

VII. QUINMESTER POST-TEST

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9. _____. Military Standard. Mil-Std-100. Washington, D.C.: U.S. Government Printing Office, 1965. Pp. 138.

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# APPENDIX

## QUINMESTER POST-TEST SAMPLE

Quinmester Post-Test

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Name _____ Date _____ Score _____

## Multiple Choice Test Items

One of the words or phrases following each statement is significant to that statement. Place the correct answer in the space provided.

___ 1. Electrical drawings are usually drawn in the form of:

a. Schematic diagrams
b. Illustrations
c. Castings

___ 2. Chassis layout is done by the draftsman and he has to use a:

a. Sketch
b. Field book
c. Detail drawing

___ 3. Electrical symbols are standard throughout the industry and the reason for this is to:

a. Build the part right
b. Improve service
c. Improve the looks

___ 4. Block diagrams are used to:

a. Aid servicemen
b. Produce the part
c. Aid the purchasing department

___ 5. Electrical measuring instruments are used to read component values with the aid of a:

a. Block diagram
b. Chassis layout
c. Schematic

___ 6. Mechanical drawings are used in electrical work and the man most used for this work is the:

a. Sheet metal man
b. Pattern maker
c. Tool and die maker

___ 7. Pictorial drawings or illustrations will be used by the:

a. Electronic engineer
b. Assembly personnel
c. Purchasing department

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___ 8. Freehand drawings may come from the technician and this is called a:

a. Mylar drawing
b. Sketch
c. Layout

___ 9. Electrical layout on architectural plans is determined by the:

a. Architect
b. Code
c. Engineer

___10. Templates are used in electrical drafting to a great degree and the reason for this is:

a. Expedience
b. Standardization
c. Cost

## True-False Test Items

Each of the following statements is either true or false. If the statement is true, draw a circle around the letter T following it; if the statement is false, draw a circle around the F. If a statement is false in part it is entirely false.

1. Schematic drawings are very important when a draftsman is required to do a tape-up. T F

2. Chassis layouts for component placement are sometimes required by the electronic industry. T F

3. Electronic drafting requires dimensions to be repeated several times to insure proper manufacturing of the part. T F

4. Printed circuit boards are common practice in the industry and were developed for the space industry. T F

5. Symbols in electronic drafting are very important and are used to simplify the drawing. T F

6. Notes are not very important on a schematic drawing because most of the information is put next to the symbol on the face of the drawing. T F

7. Draftsmen in the electronic field do not have to be very good at mechanical work because most of the work has to do with electricity. T F

8. Pictorial drawings are also used in the industry and are used to fabricate parts not shown by projection.. T F

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9. Mechanical lettering is used in the electronic industry for schematic diagram and is usually used for illustration purposes. T F

10. The dimensioning used in electronic drafting is similar to dimensioning used in the architectural field. T F

## Matching Test Items

The words and phrases in the left-hand column are significant in connection with an expression in the right-hand column. Match them properly by placing the figure preceding the item in the left-hand column in the brackets at the right of the matching item.

| | | | | |
|---|---|---|---|---|
| 1. | Vital point | a. | Common shapes | ( ) |
| 2. | Simplification | b. | For who and for what | ( ) |
| 3. | Avoid artistry | c. | Simple parts | ( ) |
| 4. | Avoid excessive details | d. | Eliminate elaboration | ( ) |
| 5. | Use templates | e. | Don't tell shop how to do work | ( ) |
| 6. | Symmetry | f. | KISS | ( ) |
| 7. | Parts list | g. | Keep assembly drawings simple | ( ) |
| 8. | Material indications | h. | Establish pattern and quit | ( ) |
| 9. | Assembly drawings | i. | Hold to a minimum | ( ) |
| 10. | For what | j. | Draw half or less | ( ) |
| 11. | For who | | | |
| 12. | Repetitive details | | | |
| 13. | Describe instead of | | | |

## Completion Test Items

Fill in the blank or blanks with the word or words that make the statement correct.

1. Screw thread call-outs end with the _____.

2. Left or right _____ thread screws are used in industry but the right is common while the left screw thread should be noted as _____.

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3. The size and material of machine screws must be called-out in the _____.

4. The types of machine screws or belts are usually called-out by the type of _____ that it has.

5. There are several types of _____ and some of the more common ones are square, Pratt & Whitney and Woodruff.

6. Button, cone, pan, round or flat head are words common with _____.

7. Common or standard type washers are purchased items and are called-out in the _____.

8. The length of a bolt is determined by the distance from the shoulder to the tip end of the bolt, but a _____ head screw or bolt is the overall length.

9. National Coarse or National Fine are _____ that are used in the manufacturing of screw threads.

10. National pipe thread is a _____ type thread.

## Order Arrangement Test Items

Listed below are various work units necessary to drawing a picture in isometric view. Number these in the order in which they are taught to be done.

___ Determine scale

___ Choose correct paper size

___ Proceed to draw the part

___ Draw border line

___ Check drawing for missing features

___ Draw title block

___ Clean board of dust or dirt

___ Sketch placement of views

___ Tape down drawing paper

___ Select tools using 30-60 triangle

## Short Answer Questions

Answer the following questions by a single word, phrase, or short sentence.

1. What type of dimensioning is used when calling-out the size of pipe?

2. What common type of drawing is used in piping drafting when one-line drawing is used?

3. What is the type of drawing called in piping drafting that is used to put the parts together?

4. What is the code of pressure called?

5. Why are symbols used extensively in piping drafting?

6. Oblique sketches are used in piping drafting. What is the other type of sketching used?

7. One-line drawing is very popular but some offices still use the older type of drawing; what is this called?

8. What is the name of the book used to refer to standard specifications in piping drafting?

9. Name at least three types of drafting fields that use piping drawings.

10. Name at least three types of drawings used in the piping field.

## ANSWER KEY TO QUINMESTER POST-TEST

**Multiple Choice Test Items**

1. a
2. a
3. b
4. a
5. c
6. a
7. b
8. b
9. b
10. a

**True-False Test Items**

1. T
2. T
3. F
4. T
5. T
6. F
7. F
8. F
9. T
10. F

**Matching Test Items**

a. 5
b. 1
c. 7
d. 3
e. 4
f. 2
g. 9
h. 12
i. 8
j. 6

**Completion Test Items**

1. Tolerance
2. Hand - LH
3. Bill-of-material
4. Head
5. Keys
6. Rivets
7. Bill-of-material
8. Flat
9. Standards
10. Taper

Order Arrangement Test Items

1. Clean board of dust or dirt
2. Sketch placement of views
3. Determine scale
4. Choose correct paper size
5. Tape down drawing paper
6. Draw border line
7. Draw title block
8. Select tools using 30-60 triangle
9. Proceed to draw the part
10. Check drawing for missing features

Short Answer Questions

1. Fractional
2. Schematic
3. Installation
4. American Standard
5. Simplification
6. Isometric
7. Two-line
8. Hand book
9. Architectural, Marine, Aeronautical
10. Schematic, Oblique, Isometric